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Article

Teacher's contingent dialogic scaffolding practices for students' expressions of argumentative agency

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Abstract
This qualitative multiple-case study explored how a biology teacher's contingent dialogic scaffolding practices facilitated the students' expressions of argumentative agency. Data such as classroom transcripts from audio and video recordings, interviews, and field notes were subjected to microlevel and macrolevel analyses using the constant comparison method. The micro-level analysis procedure was adapted from the Scheme for Educational Dialogue Analysis (SEDA) which proposes that communication has a hierarchy and nested levels at the micro (communicative acts), meso (communicative events), and macro (Communicative situations) levels. This coding scheme was chosen as it allowed for the interpretative diagnosis of how dialogic the sequences of interactions are between the teacher and the students at the micro level and the intentions of the teachers' dialogues at the macro level. All data transcripts were segmented, and initial coding utilized some codes in the classroom observation guides that merged with codes from literature to establish the final themes. Results show that her dialogic practice can be collectively characterized as flexible affirmations of the students' ideas for collective consensus, and this was implemented in two different but related strategies: 1) reinforcing a mutually contingent dialogic exercise, and 2) revoicing to increase students‟ backing and enhance their discursive identity. The study provides information on the possibility of implementing classroom argumentation in any classroom, provided that the teachers can dialogically scaffold the class and lessen the immediate evaluative responses to students' dialogues. The study, therefore, recommends that teacher educators increase pre-service teachers' exposure to inquiry approaches to science education, such as argumentation, as an investment for the development of their dialogic scaffolding for classroom argumentation.

Keywords
Argumentative agency, classroom argumentation, contingency, dialogic scaffolding

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Introduction

With the previous claims linking knowledge development and understanding to talk and inquiry, classroom dialogues can facilitate students' shared understanding and deep learning (Howe & Abedin, 2013). As such, it should be a norm for teachers to encourage interactions by giving enough dialogic scaffolding (McNeill & Pimentel, 2010). Moreover, they need to be responsive in employing dialogic talk that opens up a space for negotiation while students are engaged in knowledge construction and co-construction (Teo, 2016). Unfortunately, in biology education, there is less evidence on how teachers implement dialogic teaching in the class (Hiltunen et al., 2020).

One of the resources for scaffolding is dialogue, which has gained popularity among educational researchers in the past decades (Bakker et al., 2015). The connections were noted from the combined perspectives of dialogic teaching and scaffolding (González & DeJarnette, 2015). The concept of dialogic teaching views that students should be engaged in knowledge construction so that their participation informs the teacher on how they are progressing (Hiltunen et al., 2020; Reznitskaya, 2012; Alexander, 2006). Known as the teacher's contingent dialogue, the study hypothesizes that this is crucial as it determines the extended dialogic exchange between the teacher and the students or among the students themselves.

From the pioneer study on scaffolding, contingency of support occurs when the teacher constantly regulates the amount of scaffolding provided to the students (Wood et al., 1976). A decrease in support has to be enacted when the students succeed in their tasks; otherwise, an increase is necessary when they fail (van de Pol et al., 2019). An example of a high level of control is providing hints, while a low level of control is asking an open-ended question. According to (van de Pol et al., 2019), contingent support is characterized by an immediate teacher's response to a student who is talking at the moment. This, therefore, determines that the student's agency supports his answer, critiques his teacher, or challenges existing ideas from other students to support his answer. Thus, this study explores how a teacher's dialogic scaffolding facilitates students' expressions of argumentative agency.

Argumentation is one pedagogical method that readily comes to mind in a classroom that promotes students' participation in knowledge construction through talk. Moreover, it is a social practice that can lead to high literacy outcomes that are not limited to argumentative skills (Newell et al., 2011). These skills include constructing arguments based on evidence, anticipating, giving value to alternative arguments, and expecting counterarguments in the form of rebuttals (Rapanta, 2021). However, research shows that even higher education students encounter problems constructing arguments (Hyytinen et al., 2017). For instance, in the study (Keinonen & Kärkkäinen, 2010), science students rely primarily on personal feelings rather than scientific facts.

Moreover, students tend to use data but fail to recognize the significance of such data in constructing their arguments (Hyytinen et al., 2014, 2015). In earlier research, students are not critical of the lack of evidence for their claims (Sandoval, 2003). It is, therefore, necessary that teachers are readily available to provide contingent dialogic scaffolding that would enhance the students' argumentative agency.

Research Questions:

This study mainly addressed two research questions:

1. What contingent dialogic scaffolding practice did the biology teacher employ in her classroom to elicit the students' expressions of argumentative agency?
2. How did the teacher implement this contingent dialogic scaffolding practice to encourage students' expressions of argumentative agency?

Theoretical framework

Contingency in scaffolding

The principles of scaffolding were derived from the ideas of the ZPD. Simply put, scaffolding is temporary and assisted learning which accumulates over time to establish independence in a dynamic system between the mentor (teacher) and the student. Moreover, it is the gradual development of confidence and capability of learners to accomplish tasks at hand (Lajoie, 2005). Understanding the dynamics of this system determines the interrelationship of the scaffolding phases: contingency, fading, and transfer of responsibility in the context of the actors involved in the process (i.e., teachers and learners). In the dynamic system of scaffolding, the contingency is the process wherein teachers tailor or customize their instructional strategies according to the students‟ capacities. Initially termed as "providing just the right amount of support," it refers to the provision of scaffolding that corresponds to the requirements of the developed skills from the learning tasks in the contingency or dynamic assessment. Transfer of responsibility (van de Pol, 2012) is the final phase of the scaffolding process. It is also termed intersubjectivity and can be achieved by learners because of acquired knowledge and skills in performing the tasks from a series of support from the previous phases. Contingent dialogic scaffolding in this study was used as discursive support provided by the teacher to elicit students' willingness to participate in the dialogic inquiry with solicited responses as expressions of their argumentative agency. Contingency is also termed a dynamic assessment (van de Pol, 2012) with a premise that understanding the level of support at this stage would help in the customization of the amount of scaffolding the mentors will provide for the learners that would lead them to the fading phase.

In summary, grounded on social interactions, dialogic scaffolding combines the ideas of constructivism, sociocultural theory, and ZPD in the social processes of achieving scientific reasoning and higher-order thinking skills. Therefore, Vygotsky's use of language as a tool for cognitive development in the social phenomenon of knowledge acquisition in science education can be dialogically scaffolded in classroom argumentation. Active learning in social constructivism, cultural influence, language use in the co-construction of knowledge in SCT, and scaffolding of the ZPD encompass the logic behind the conduct of this study.

Argumentative agency

In this study, the argumentative agency was derived from epistemic agency. Epistemic agency theories (Damşa et al., 2010) state that the emergent characteristic of a group allows them to make progress during collaborative knowledge construction. Thus, the epistemic agency is observable when students participate in classroom argumentation through joint negotiations. Furthermore, their argumentative agency are observable when they respond and uptake the teacher's dialogic prompts, which elicit their claims, evidence, and justifications for a particular argument or counterargument. Since the

study hypothesizes that learners express argumentative agencies when they uptake the teacher's feedback, they become argumentative agents who sustain the classroom argumentation.

Argumentative agency is used as the role played by the students' uptake of the teachers' feedback as they participate in their argumentative discussions. There is an emphasis on the modifier "argumentative" because the feedback elicited claims with valid evidence and justifications for their arguments and counterarguments. With the rationale that when language in the form of dialogic prompts is appropriately utilized, teacher feedback and students' uptake sustain the discussion.

Methodology

The study employed the qualitative case study research design involving a biology teacher and her Grade 8 students. A robust amount of data which was analyzed to establish themes representative of the teacher's dialogic scaffolding for students' expressions of the argumentative agency, were taken from audio and video transcripts. Thematic analyses of the teacher's dialogic scaffolding practice and her implementation strategies for students‟ expressions of argumentative agency followed the grounded theory methodology through the constant comparison method. This was applied to five 50-minute classroom transcripts to develop themes representing teachers' contingent dialogic scaffolding practice and implementation strategies. Teachers' dialogues were categorized into three types: 1) conceptual (orienting to hint and exploring prerequisite knowledge), 2) analytical (generating ideas and explanations and presenting argumentative prompts), or 3) reflective (probing further and enabling reflective thinking). These dialogues played various roles: linking statements to prior experience, recapitulating, appropriating, recasting, cued eliciting, and increasing perspectives.

On the other hand, students' dialogues were categorized as either constructive (reasoner and support) or critique (challenger, clarifier, or evaluator). In the coding process, themes were developed using the combined inductive and template approaches, which merged the a priori and data-driven codes. The generated codebooks were mainly focused on the types of dialogues and the roles played by these dialogues to establish the interplay of the teacher's and the students' contingent argumentative interactions.

Results of the study

RQ 1. What contingent dialogic scaffolding practice did the biology teacher employ in her classroom to elicit the students' expressions of argumentative agency?

Results showed that the teacher's dialogic scaffolding practice was through her flexible affirmations of the students' ideas for collective consensus, and this was implemented in two different but related strategies: 1) providing reinforcement for a mutually contingent dialogic exercise, and 2) revoicing to increase students' backing and enhance their discursive identity.

Providing reinforcement for a mutually contingent dialogic exercise

This dialogic scaffolding practice is characterized by the teacher adding input into what the students are saying to increase the available information which

can be used for discussion. This information serves as 'dialogic bids,' which students can use to enhance their responses or awaken their prior knowledge. Moreover, the teacher combined the use of everyday language and scientific language to simplify the terms that were new and difficult for the students. Everyday languages serve as basic ideas which can slowly be refined to match scientific ideas for easier understanding. Students' agencies to participate in the dialogic exchange are enhanced through everyday language. This strategy corroborates previous studies on using the students' intuitive and raw preconceptions of science to mediate knowledge construction (Furberg & Silseth, 2021; Luna, 2018).

Revoicing to increase students' backing and enhance their discursive identity

The other dialogic scaffolding practice is revoicing to increase students' backing and enhance their discursive identity. In this strategy, the teacher took up and emphasized their ideas so that they recognize the value of the discussion. In this practice, the teacher withheld evaluations of the responses in order to extend the discussion. Instead, the teacher asked for elaborations addressed to the whole class. The idea supports Nystrand's (1997) earlier claims on uptake effectiveness when followed up with seeking elaborations or explanations. However, while teacher-directed, asking for explanations and elaborations requires higher-order knowledge. Thus, to facilitate effective dialogue in the classroom through teachers' reinforcement, learners have to be provided with higher-order dialogic scaffolding input.

Providing affirmative dialogic prompts as scaffolds in this study was regarded as allocating everyone's role in the discussion and giving them space to express their varying opinions, which served as grounds for mutual exchange and building science concepts. Furthermore, through this dialogic scaffolding practice, their inquiry process opened new perspectives while learning to think critically about new possibilities by comparing different points of view. The following section will discuss the implementation of contingent dialogic practices using sample transcripts.

RQ2: How did the teacher implement this contingent dialogic scaffolding practice to encourage students' expressions of argumentative agency?

Providing reinforcement for a mutually contingent dialogic exercise

As shown in Transcript 1, the teacher kept acknowledging the students' statements and revoicing them as a form of contingent dialogue to elicit more responses. Through reflective dialogic prompts, she kept drawing out further explanations and minimized corrective feedback that might contradict her affirmative dialogues. For instance, in Turn 8 of the transcript, when her question was given an elaborated answer by Francis (Turn 9), she used Diana's, Leslie's, Linda's, and Kevin's reasons from their previous responses to bring out the formal topic of their discussion which was the understanding of the advantages of studying the pattern of inheritance. Noticeably, the common grounds in the students' ideas were supportive of each other, and there was already an explanation of the correct answer in the first statement. However, she tried to draw out more ideas and increase the depth of knowledge formation by asking reflective questions resulting in answers from varied points of view.

Transcript 1. Sample coded transcript on their lesson on 'Introduction to the pattern of inheritance in humans'

Turn	Speaker	Dialogic interactions / codes
1	Teacher:	What do you think is the main reason why we study the mode of inheritance for humans? / (Ana; Increa pers)
2	Diana:	Ma'am, it is because we need to learn the mode of transmission of diseases in humans. (Reas)
3	Teacher:	Do we really need to know this? / (Refl; Increa pers)
4	Leslie:	Yes, Ma'am, so we know how to be cautious about our health. / (Reas)
5	Teacher:	But it is said that it is already inherited; can we do something about it? / (Ana; Cued eli)
6	Linda:	Of course, Ma'am…that is why we need to determine our lifestyle. / (Reas)
7	Kevin:	Yes, Ma'am, like my aunt, she has diabetes…so her children are all cautious with their sugar intake because they might have inherited the diabetes from their Mom. / (Sup)
8	Teacher:	So is there a way to know this pattern of inheritance? / (Conc; Pri knowl)
9	Francis:	Yes, Ma'am, for diseases, they usually go to the doctor, and we know what diseases can be hereditary. / (Reas)
10	Teacher:	Ok, right…that brings us to know the different patterns of inheritance, say, for example, Huntington's disease. What do you have there for your homework? / (Conc; Cued eli)

In the dialogic exchange, she tried to bring out students' opinions on the significance of studying the mode of inheritance in humans. In Turn 1 of the transcript, Diana was right when she said that they need to study the patterns of inheritance as prerequisite knowledge to understand the inheritance of diseases. As she recognized and recast her answer, a related reason was provided by Leslie when she said about health management. Moreover, these answers were supplemented by the succeeding responses of Linda with a supportive statement relating the study of the mode of inheritance in humans to maintaining a healthy lifestyle and further explained by Kevin using an example from his experience.

Revoicing to increase students' backing and enhance their discursive identity

The transcripts' analysis revealed that the teacher's revoicing as a contingent dialogic scaffolding practice was instrumental to the co-generation of argumentative dispositions and created alignment of students' ideas towards consensus in the meaning-making process. The class could engage in argumentation with many solicited or unsolicited dialogic exchanges. This practice are evident in their dialogic interactions in Figure 2 when she allowed the conceptual dialogic exchanges among Kyrie, Lea, and Gina (Turns 2 to 5) and then recapped Lea's response (Turn 6). Much as Kyrie's response was not related to the recapped statement, Matthew was prompted to clarify their doubts about Kyrie (Turn 2 and Turn 7) at the start of their dialogic exchanges,

which continued even until after the teacher had already recapped Lea's response, a pre-supposed cue for him. Another contingent dialogue was prompted by the teacher in Turn 10 when she asked about the implications of the ratios obtained from Punnet Square. However, it was still not clear to Kyrie, but the teacher did not give explanations. Instead, she waited for other students to present the explanations to Kyrie's ongoing clarifications, as exemplified by Pearl when she presented a summary of the various viewpoints raised by her classmates (Turns 10 to 12) in response to the doubts Kyrie had about their lesson.

Transcript 2. Sample coded transcript on their lesson on 'Punnet Square'

Turn	Speaker	Dialogic interactions/codes
1	Teacher:	So what can you observe in the pedigree? / (Conc; Cued eli)
2	Kyrie:	Ma'am, why is it that two offspring are healthy?/ (Cla)
3	Lea:	No, three are healthy. / (Eval)
4	Gina:	Why do you say three are healthy? / (Chall)
5	Lea:	The third offspring is the only carrier. So only one is affected! / (Cla)
6	Teacher:	Ok, it was mentioned that only one is affected. / (Conc; Recap)
7	Kyrie:	But the ratio is 1:2:1… so two should be carriers, right? / (Chall)
8	Matthew:	Oh, my! It is your chance, do not mind your siblings. It does not depend on the number of your siblings. / (Reas)
9	Teacher:	What does the ratio tell us? / (Conc; Cued eli; Pri knowl)
10	Pearl:	Yeah, it can be like you are not affected, a carrier, or affected. / (Reas)
11	Kyrie:	But it is in Punnet Square!/ (Chall)
12	Pearl:	Yes, it can be shown in Punnet Square but do not mind the others. What if the parents only have one child? So meaning that any of the three can be their daughter or son. / (Cla)
13	Kyrie:	Ok, got it.

In this dialogic interaction, the teacher was keen not to give evaluative prompts but instead continued to recap and bring in the doubts of the students (Kyrie in the case) to the argumentative discussions. Taking Kyrie's case, he did not hesitate to raise all his doubts as the teacher acknowledged his role in the discussions. Thus, his expression of the argumentative agency was not suppressed; instead, he was more empowered to listen and present all his clarifying dialogues, which his more knowledgeable peers readily answered. Through this dialogic practice, their discursive interactions are toward sense-making.

Discussion and Conclusion

This study explored a teacher's contingent dialogic scaffolding practices to improve the students' argumentative agency. According to Teo (2016), classroom learning combines instruction and dialogue. More than conceptual and factual knowledge, teachers' contingent dialogic scaffolding for argumentation is a promising method for the gradual enhancement of students‟ communication skills and honing of their reasoning abilities as they were provided with a learning environment that allowed the full expressions of their argumentative agency such as supporting reasons, clarifying arguments and counterarguments, evaluating claims and evidence, and providing reasons as initial responses to dialogic prompts. The varying viewpoints, however, were recognized by everyone as their foundational knowledge influenced by their culture, schemas, and prior experiences. Thus, dialogic inquiry exemplified in the teacher's classroom in this study can be synonymous with collective argumentation, where ideas were recognized, understood, and clarified to reach an agreement with broader validated reasons from different perspectives. Through this dialogic scaffolding practice, their inquiry process opened new perspectives while learning to think critically about new possibilities from different points of view.

In these contingent dialogic practices, students' ideas were not evaluated immediately, which supported their reflection on the quality of their ideas. As the teacher provided reinforcement and revoiced their ideas, every student's agency was allocated in the discussion while giving them space to express their opinions. The finding supports earlier claims emphasizing collaborative knowledge building wherein the teacher and students are alternately involved in the attempts to solve conflicting ideas toward knowledge co-construction (Mercer & Littleton, 2007). Dialogue became a vehicle for collaborative inquiry wherein each student's contributions were considered a valuable resource in knowledge generation (Higham, 2016; Kazepides, 2012; Bakhtin, 1982). In language studies, Chin (2006) considered affirmation a repair-and-enrichment approach. Its purpose is to re-align students' thinking toward desired understanding. Thus, it has been criticized for its tendency to approach authoritative teacher talk (Chin, 2006). Contrasting results, observed in the teacher's affirmative dialogues, transferred the responsibility for the students to construct and reconstruct their understanding as they took turns answering questions from their classmates. She also honored her students' ideas and triggered others to participate with alternative ideas through her dialogic prompts. The result aligns with the previous claims of (Franke & Kazemi, 2001), who emphasized that being a responsive teacher in a dialogic classroom is not only giving feedback but carefully noticing what students say and acting intelligibly for critical dialogues can be utilized to motivate further participation.

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Author's Bionote

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